## Space Weather Technical Forecast

Issued on Wednesday 19 February 2025 at 01:02 Local

**This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

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**Space Weather Forecast Headline: M-class flares likely. Slight Chance of G1/Minor Storm on Day 1 (19 Feb) due to CME arrival.**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Solar activity has been Low, with a peak flare C5.7 at 18/0108 UTC from AR3990 in the southwest.

There are currently eight sunspot regions on the visible disc. AR3992 has now rotated off the west limb. AR3990 has faded over the last 24 hours and has now lost its opposite polarity spots, reverting to a more straightforward magnetic structure. However, this region does have a connected filament, which extends to its southeast, which has recently become unstable and will continue to be monitored for any potential lift-off. AR3996 in the southeast has shown some minor growth of intermediate spots, but remains fairly simple magnetically. AR3998 has shown some growth within its intermediate area. The remaining regions appear relatively simple at present.

No Earth-directed CMEs have been observed. The filament near AR3990 showed some instability starting around 18/0000 UTC, but no CME is apparent in available imagery.

**Solar Wind / Geomagnetic Activity:** Solar winds as measured by ACE and DSCOVER at L1, showed a connection to a fast wind from CH15/-. Wind speeds were slightly elevated or elevated, varying between 450-540 km/s. Density was average to slightly above. Interplanetary Magnetic Field, Bt, was mostly weak, but recently reached moderate around 10nT. The north-south component, Bz, was mostly weak, until the arrival of a CME 18/1930UTC, becoming moderately negative (southward) at -10nT. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3), with an Active interval at 18/2100-0000 UTC, due the CME arrival.

**Energetic Particles / Solar Radiation:** High energy proton flux (greater than 10MeV) at GOES18 persisted at background levels. High energy electron flux (greater than 2MeV) at GOES16 was moderate to high, peaking at 1510pfu at 18/2155UTC. The associated 24-hour fluence was below the Active threshold (1e8 integrated pfu), with the 19/0000UTC observation being 9.5e7 integrated pfu.

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# Space Weather Technical Forecast

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** Solar activity is forecast to be Low to Moderate, with isolated M-class flares likely.

**Solar Wind / Geomagnetic Activity:** There are no CMEs currently assessed as Earth directed. However, a glancing CME was observed arriving at L1 at 18/1930 UTC, with a steady rise in the solar wind speeds to near 500km/s. The CME probably left the Sun during the 14-15 Feb. Otherwise, slightly elevated solar wind speeds are expected to gradually ease to background as the influence of CH15/- wanes. Geomagnetic activity will be mostly Quiet to Active with a Slight Chance of a G1/Minor Storm early on Day 1 (19 Feb) due to the aforementioned recent CME arrival.

**Energetic Particles / Solar Radiation:** High energy proton flux is expected to persist at background levels, with a slight chance of rising above S1 in response to any larger flares. High energy electron flux is expected to remain Moderate to High.

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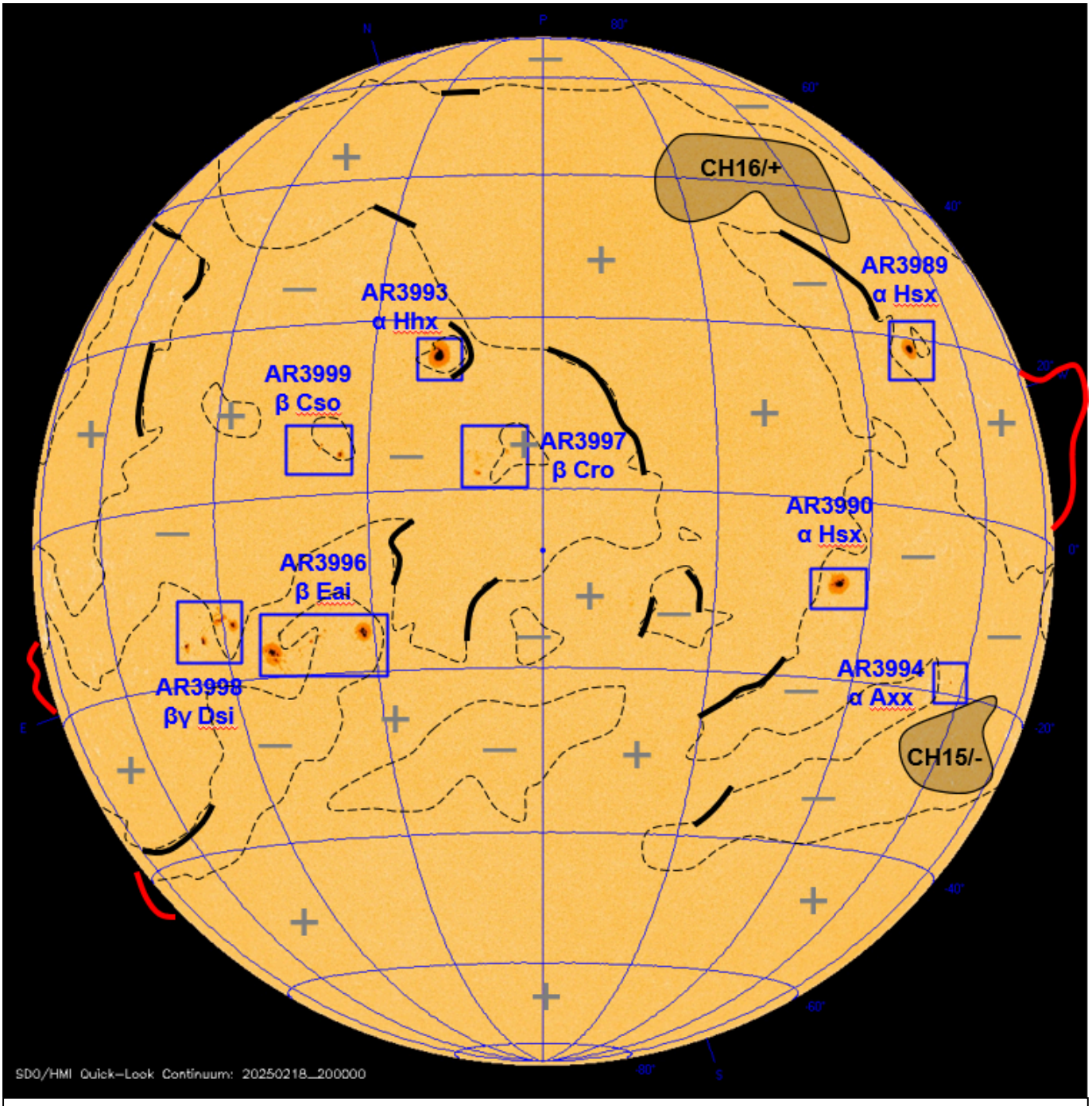
**Figure 1: Solar synoptic map, valid at 18/2000 UTC.**




**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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## Geomagnetic Storms

Several CMEs were observed leaving the Sun on February 14th and 15th, mostly originating from AR3990 or AR3994, and from a filament eruption. Confidence in all of the CMEs is low, with limited coronagraph imagery for analysis and an apparent eastward deflection of the CMEs, likely due to CH15/-.

However, a recent glancing CME has arrived at L1, with the Bz becoming moderately negative (southward), with a slight upward trend in the solar wind speeds, near 500km/s. Geomagnetic activity will be mostly Quiet to Unsettled with a chance of Active intervals early on Day 1, and a slight chance of G1/Minor Storm, due to the recent CME arrival.

Otherwise the ongoing fast wind conditions, now originating from CH15/-, are expected to continue to gradually ease from elevated to background levels by the end of the period. This is supported by MOSWOC Enlil.

| Geomagnetic Storm Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 20 | 1 | 1 | 1 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

**Figure 2: L1 magnetometer shows the arrival of a CME at 18/1930 UTC.**

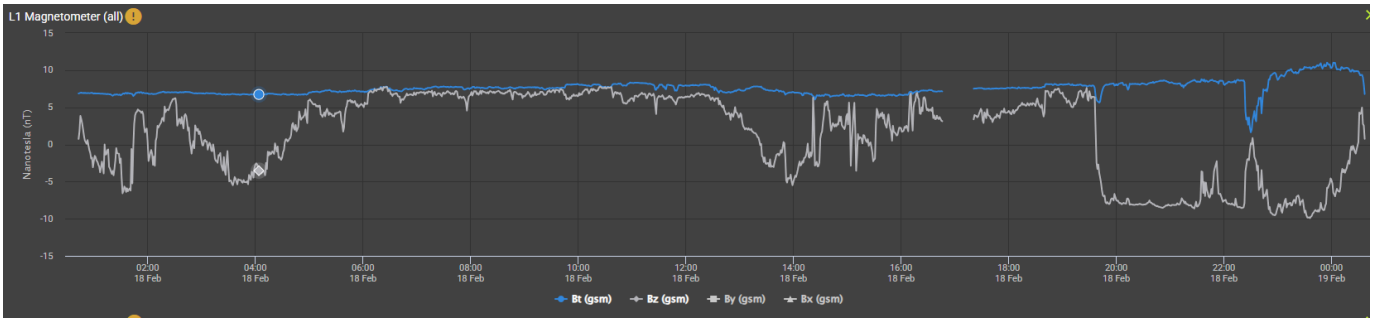


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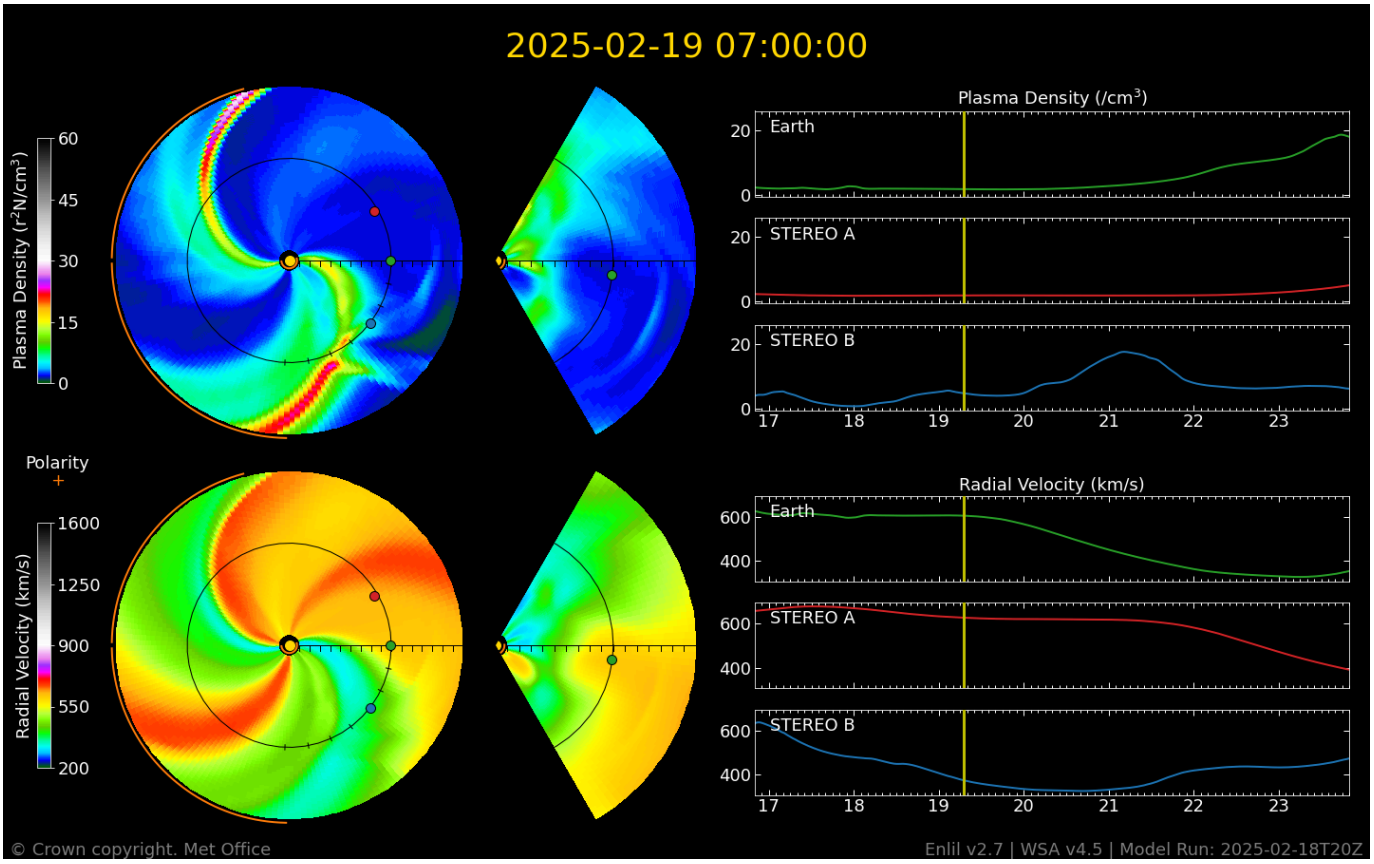
**Figure 3: MOSWOC ENLIL - shows a gradual exit from recent HSS from CH14-15.**



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## Radio Blackouts - X-Ray Flares

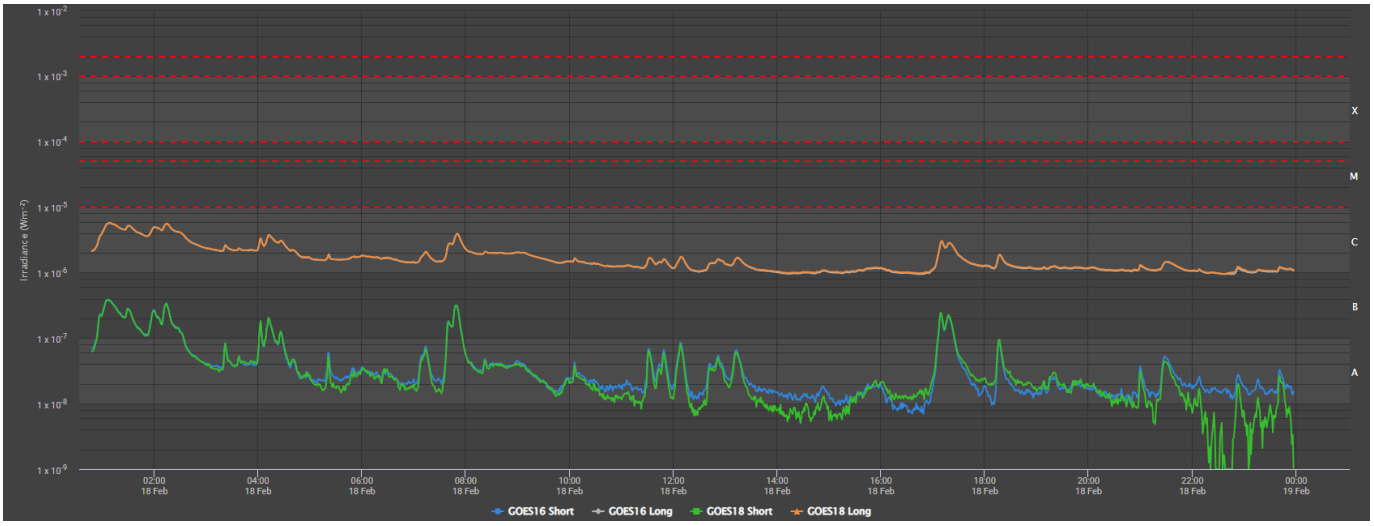
Solar activity has been Low, with a peak flare C5.7 at 18/0108 UTC from AR3990 in the southwest.

There are currently eight sunspot regions on the visible disc, with AR3991 having faded. AR3992 has now rotated off the west limb. AR3990 has faded over the last 24 hours and has now lost its opposite polarity spots, reverting to a more straightforward magnetic structure. However, this region does have a connected filament extending to its southeast, which has recently become unstable and will continue to be monitored for any potential lift-off. AR3996 in the southeast has shown some minor growth of intermediate spots, but remains fairly simple magnetically. AR3998 has shown some growth within its intermediate area. The remaining regions appear relatively simple at present.

Activity is forecast to be Low to Moderate, with isolated M-class flares likely. These perhaps most probable from the developing regions on the eastern disc, or perhaps from AR3990 if any further disruption occurs with its connected filament.

| X-Ray Flares Probability | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| Active | R1-R2 (M Class) | No | 40 | 50 | 60 | 60 |
| Very Active | R3-R5 (X Class) | No | 5 | 5 | 5 | 5 |

**Figure 4: GOES18 X-Ray flux trace**

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## Solar Radiation Storms (High Energy Protons)

GOES18 high energy proton flux is most likely to persist at background levels, but with a slowly increasing chance of enhancement due to any flaring from AR3990 as this region moves further across the better connected western hemisphere. Along with an increasing risk from AR3996 and AR3998, and other developing regions, as they move towards the centre disc, this brings a slight chance of the observed flux rising above the S1/Minor radiation storm threshold.

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}sr^{-1}s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ S1** | No | 10 | 10 | 10 | 10 |
| **Very Active** | **≥ S3 *** | No | 1 | 1 | 1 | 1 |
| * S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$) | | | | | | |

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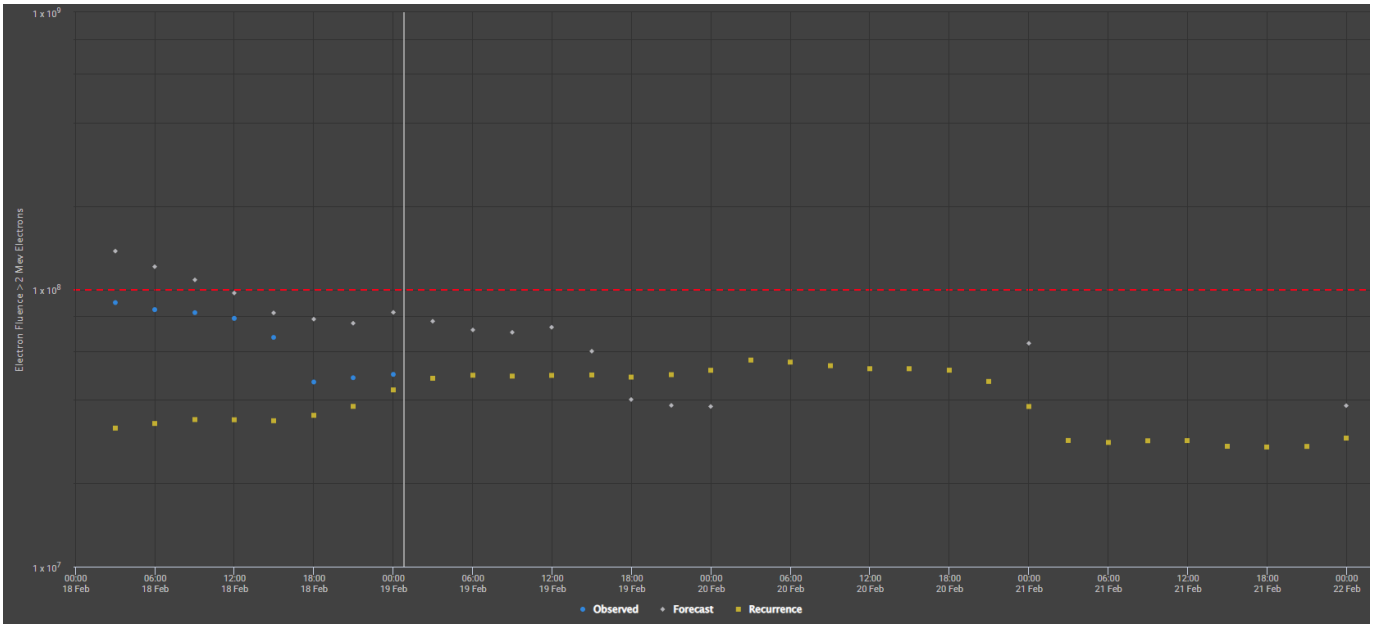
## High Energy Electrons (≥ 2MeV)

High energy electron flux as observed at GOES-16 has been Moderate to High, due to the charging within the Van Allen Belt that recently occurred from the connection to the fast wind of CH14/15. As solar winds continue to ease, this charged environment is expected to largely persist, although there are signs of a decreasing trend with the current observations running lower than they were 24 hours previously. However, there is just a chance of the easing wind speeds allowing increased flux from lower orbits to expand towards GEO, so a renewed rise is not completely out of the question. However, the recent arrival of a weak glancing CME may suppress the electron flux. Overall, confidence is low.

The associated 24 hour fluence did reach the Active (1e8 integrated pfu) threshold on 17 Feb, but has since dropped below the Active level. Fluence is likely to remain below the Active threshold. Confidence for Active fluence during the period is low, but there is a chance of this occurring. MOSWOC REFM is now also forecasting fluence levels to remain below the Active threshold.

| GEO Electron Environment | Level ($cm^{-2}sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability (Exceedance) | | | (%) | (%) | (%) | (%) |
| Active | ≥ 2 MeV ≥ $1\times10^{8}$ | No | 40 | 30 | 20 | 20 |
| Very Active | ≥ 2 MeV ≥ $1\times10^{9}$ | No | 1 | 1 | 1 | 1 |

**Figure 5: MOSWOC REFM electron fluence.**

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